64th Congress
1st Session

SENATE

Document
No. 310

GASOLINE

LETTER

FROM THE

SECRETARY OF THE INTERIOR

TRANSMITTING

CERTAIN INFORMATION, IN RESPONSE TO A
SENATE RESOLUTION OF JANUARY 5, 1916,
RELATIVE TO THE PRODUCTION,
CONSUMPTION, AND PRICE
OF GASOLINE

February 3, 1916.—Referred to the Committee on Printing

WASHINGTON
GOVERNMENT PRINTING OFFICE
1916

REPORTED BY MR. FLETCHER.

In the Senate of the United States,
February 7, 1916.

Resolved, That the report on production, consumption, and price of gasoline, submitted by the Secretary of the Interior on February 2, 1916, in response to Senate resolution No. 40, Sixty-fourth Congress, be printed as a Senate document, together with accompanying illustrations.

Attest:

James M. Baker, *Secretary.*

LETTER OF TRANSMITTAL.

THE SECRETARY OF THE INTERIOR,
Washington, February 2, 1916.

DEAR SIR: I beg to acknowledge receipt of Senate resolution No. 40, asking for certain information as to the production, consumption, and price of gasoline, and in reply thereto submit the following answers.

Respectfully,

FRANKLIN K. LANE,
Secretary.

HON. THOMAS R. MARSHALL,
Vice President of the United States.

SENATE RESOLUTION NO. 40.

IN THE SENATE OF THE UNITED STATES.

JANUARY 5, 1916.

Mr. McCUMBER submitted the following resolution; which was considered by unanimous consent, amended, and agreed to.

Resolved, That the Secretary of the Interior be directed to furnish the Senate, for its use, such information as his department may have on the production, consumption, and price of gasoline, as follows:

First. The total amount of gasoline produced in the United States each year since nineteen hundred.

Second. The amount of gasoline consumed in the United States each year during said period.

Third. The several fields of production in the United States and the amount produced in each field during said period.

Fourth. What has been the prevailing wholesale price of crude oil at the several fields of production each year during said period.

Fifth. What fields and to what extent are becoming exhausted.

Sixth. What new fields have been developed during said period, and the production of such new fields.

Seventh. What known fields or areas are yet undeveloped, and what are their possibilities for oil and gasoline production, in the United States and elsewhere.

Eighth. What new method or methods have been evolved to increase the percentage of gasoline produced from the crude oil or to cheapen the cost of production in any way.

Ninth. To what new uses have gasoline and petroleum or coal oil been applied during the said period.

Tenth. So far as the records of his department will disclose, what has been the production and consumption of gasoline in the world, outside of the United States, each year during said period.

Eleventh. To what extent have the war conditions in Europe influenced the production and consumption of gasoline.

Twelfth. What cause, if any, can be given for the sudden extraordinary rise in the retail price of gasoline.

Thirteenth. To what extent has the interior-combustion engine been responsible for the increased consumption of gasoline, and what has been the extent of the increase of such engines and their general uses during said period, with special reference to number and increase of stationary engines, farm traction engines, automobiles and motor boats, and so forth.

Fourteenth. What fields are now nonproductive or limited in their production because of deficiencies in the laws in relation to the disposition of public lands containing deposits of oil, and what areas have been withdrawn from entry to await action by Congress.

Fifteenth. Any other information which may be useful or beneficial in the consideration of the subject of production and consumption of gasoline.

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PRODUCTION, CONSUMPTION, AND PRICE OF GASOLINE.

[Gasoline is a commercial term with no fixed meaning and as used in these answers includes naphthas and other lighter petroleum products.]

[All statistics for both crude oil and gasoline are given in terms of barrels of 42 gallons each.]

1. *The total amount of gasoline produced in the United States each year since 1900.*

The only available figures for this period are those given by the census for the years 1899, 1904, 1909, and 1914, to which is added an estimate for 1915.

Gasoline produced.

	Barrels.
1899	6, 680, 000
1904	6, 920, 000
1909	12, 900, 000
1914	34, 915, 000
1915	41, 600, 000

2. *The amount of gasoline consumed in the United States each year during said period.*

There are no exact figures available for gasoline consumption. An indication of the domestic consumption may be found by deducting the amount exported from the amount produced. This fails, however, in so far as it does not take into consideration changes in gasoline stocks from year to year. It is conservatively estimated that there was an excess of 2,000,000 barrels of gasoline stocks in storage January 1, 1915, which are reported as practically exhausted on January 1, 1916.

Year.	Production.	Exported.	Difference.
1899	6, 680, 000	297, 000	6, 383, 000
1904	6, 920, 000	594, 000	6, 326, 000
1909	12, 900, 000	1, 640, 000	11, 260, 000
1914	34, 915, 000	5, 000, 000	29, 915, 000
1915	41, 600, 000	6, 500, 000	35, 100, 000

3. *The several fields of production in the United States and the amount produced in each field during said period.*

4. *What has been the prevailing wholesale price of crude oil at the several fields of production each year during said period?*

[The answers to questions 3 and 4 are combined in order to present production and prices in the same tables.]

The areas of crude-oil production in the United States are assigned to ten major fields. This division is based mainly on geographic distribution, but it incidentally expresses to a considerable degree differences in the character of the petroleum produced. The term "field" is used in this discussion in its geographic sense to designate a region of indefinite boundaries that includes a number of subordinate and generally detached areas of actual oil production referred to as pools. The ten fields are:

The *Appalachian field,* including all areas of oil production in southwestern New York, western Pennsylvania, southeastern Ohio, western West Virginia, Kentucky, and Tennessee.

The *Lima-Indiana field,* embracing all areas of oil production in northwestern Ohio and eastern Indiana, as well as a few scattered pools of limited extent in the western part of the latter State.

The *Illinois field,* including the principal oil-producing area in the southeastern part of Illinois and scattered pools in the south-central and western parts of the State.

The *Mid-Continent field,* including all areas of petroleum production in Kansas and Oklahoma irrespective of the character or grade of oil produced.

The *North Texas field,* embracing a number of detached pools in Wichita, Clay, Shackelford, Palo Pinto, Navarro, and Williamson counties in the north and east central parts of Texas.

The *Northwest Louisiana field,* including areas of oil production in Caddo, De Soto, Sabine, and Red River parishes in the northwestern part of Louisiana, together with adjoining portions of Harrison and Marion counties, Texas.

The *Gulf field,* embracing a large number of oil pools associated with salt domes in southeastern Texas and southern Louisiana.

The *Colorado, Wyoming,* and *California* fields include all areas of oil production occurring, respectively, in the States named.

Small quantities of oil are or have been produced in Missouri, Michigan, New Mexico, Utah, Montana, Washington, and Alaska.

The marketed production of petroleum from each of these ten fields is shown in the following tables, by years from 1900 to 1914, inclusive, together with the average yearly price of oil at the wells, with estimates of production for 1915, and average daily quotations for the principal grade of oil produced in each field.

Crude petroleum production and prices by fields.

APPALACHIAN FIELD.

Year.	Quantity.	Yearly average price per barrel.	Year.	Quantity.	Yearly average price per barrel.
1900	36,295,433	$1.353	1908	24,945,517	$1.780
1901	33,618,171	1.210	1909	26,535,844	1.646
1902	32,018,787	1.238	1910	26,892,579	1.336
1903	31,558,248	1.590	1911	23,749,832	1.308
1904	31,408,567	1.628	1912	26,338,516	1.626
1905	29,366,960	1.394	1913	25,921,785	2.458
1906	27,741,472	1.598	1914	24,101,048	1.877
1907	25,342,137	1.745	1915	23,650,000	1.56

LIMA-INDIANA FIELD.

1900	21,758,750	$0.982	1908	10,032,305	$1.003
1901	21,933,379	.854	1909	8,211,443	.907
1902	23,358,626	.890	1910	7,253,861	.793
1903	24,080,264	1.155	1911	6,231,164	.821
1904	24,689,184	1.092	1912	[1] 4,925,906	.932
1905	22,294,171	.873	1913	4,773,138	1.380
1906	17,554,661	.907	1914	5,062,543	1.182
1907	13,121,094	.912	1915	4,300,000	0.93

[1] Includes Michigan.

Crude petroleum production and prices by fields—Continued.

ILLINOIS FIELD.

Year.	Quantity.	Yearly average price per barrel.	Year.	Quantity.	Yearly average price per barrel.
1900	200	$5.000	1908	33,686,238	$0.672
1901	250	5.000	1909	30,898,339	.640
1902	200	5.000	1910	33,143,362	.593
1903	....	....	1911	31,317,038	.630
1904	....	....	1912	28,601,308	.851
1905	181,084	.644	1913	23,893,899	1.296
1906	4,397,050	.745	1914	21,919,749	1.160
1907	24,281,973	.677	1915	18,500,000	.990

MID-CONTINENT FIELD.

1900	81,186	$0.916	1908	47,600,546	$0.387
1901	189,151	.857	1909	49,122,982	.364
1902	368,849	.882	1910	53,157,386	.383
1903	1,071,125	1.055	1911	57,348,456	.472
1904	5,617,527	.969	1912	53,019,867	.674
1905	12,013,495	.545	1913	65,954,413	.937
1906	21,718,648	.443	1914	76,735,309	.778
1907	45,933,649	.402	1915	106,500,000	.610

NORTH TEXAS FIELD.

1900	836,039	$1.043	1908	723,264	$0.662
1901	800,545	.769	1909	681,940	.577
1902	617,871	.681	1910	969,403	.521
1903	501,960	1.026	1911	2,251,193	.539
1904	569,102	.724	1912	5,275,529	.779
1905	520,282	.695	1913	9,184,252	.992
1906	1,117,905	.662	1914	9,451,622	.823
1907	912,618	.791	1915	8,000,000	.630

NORTHWEST LOUISIANA FIELD.

1906	3,358	$0.650	1911	6,995,828	$0.522
1907	50,000	.277	1912	7,177,949	.755
1908	499,937	.428	1913	9,781,560	1.003
1909	1,028,818	.533	1914	11,808,469	.949
1910	5,090,793	.450	1915	15,500,000	.650

GULF FIELD.

1901	3,593,113	$0.175	1909	10,883,240	$0.723
1902	18,014,404	.209	1910	9,680,465	.763
1903	18,371,383	.411	1911	10,999,873	.669
1904	24,631,269	.357	1912	8,545,018	.742
1905	36,526,323	.240	1913	8,542,494	.936
1906	20,524,162	.457	1914	13,117,528	.674
1907	16,360,299	.837	1915	21,000,000	.450
1908	15,772,137	.603			

COLORADO FIELD.

1900	317,385	$1.019	1908	379,653	$0.913
1901	460,520	1.000	1909	310,861	1.023
1902	396,901	1.220	1910	239,794	1.015
1903	483,925	.892	1911	226,926	1.005
1904	501,763	1.152	1912	206,052	.973
1905	376,238	.897	1913	188,799	.926
1906	327,582	.802	1914	222,773	.902
1907	331,851	.822	1915	200,000	[1] .800

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[1] Estimated.

Crude petroleum production and prices by fields—Continued.

WYOMING FIELD.

Year.	Quantity.	Yearly average price per barrel.	Year.	Quantity.	Yearly average price per barrel.
1900	5,450	$7.000	1908	[2] 17,775	$1.570
1901	5,400	7.000	1909	[2] 20,056	1.718
1902	6,253	7.000	1910	[2] 115,430	.810
1903	8,960	7.000	1911	[2] 186,695	.664
1904	11,542	7.000	1912	1,572,306	.507
1905	8,454	6.100	1913	2,406,522	.493
1906	[1] 7,000	7.000	1914	3,560,375	.472
1907	[2] 9,339	2.343	1915	4,200,000	[1] .480

CALIFORNIA FIELD.

Year.	Quantity.	Yearly average price per barrel.	Year.	Quantity.	Yearly average price per barrel.
1900	4,324,484	$0.943	1908	44,854,737	$0.523
1901	8,786,330	.566	1909	55,471,601	.554
1902	13,984,268	.348	1910	73,010,560	.490
1903	24,382,472	.303	1911	81,134,391	.477
1904	29,649,434	.279	1912	87,272,593	.454
1905	33,427,473	.245	1913	97,788,525	.467
1906	33,098,598	.289	1914	99,775,327	.482
1907	39,748,375	.370	1915	89,500,000	.510

MISSOURI, ETC., FIELDS.

Year.	Quantity.	Yearly average price per barrel.	Year.	Quantity.	Yearly average price per barrel.
1900	[3] 1,602	$0.735	1908	[3] 15,246	$1.466
1901	[3] 2,335	1.114	1909	[3] 5,750	1.362
1902	[3] 757	1.408	1910	[3] 3,615	1.326
1903	[3] 3,000	1.550	1911	[3] 7,995	1.000
1904	[3] 2,572	1.854	1912	(4)	....
1905	[3] 3,100	1.071	1913	[5] 10,843	1.777
1906	[3] 3,500	1.397	1914	[6] 7,792	1.834
1907	[3] 4,000	1.625	1915	50,000	(7)

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[1] Estimated.
[2] Includes Utah.
[3] Includes Michigan.
[4] No production for Missouri; Michigan included in Lima-Indiana.
[5] Includes Alaska, Michigan, and New Mexico.
[6] Includes Alaska and Michigan.
[7] Not available.

The petroleum produced in these major fields differs in physical and chemical character, and the types of petroleum found in the different districts of a single field may show wide variations. Therefore purchasing agencies classify the output of each field according to grade and quote prices thereon. The average yearly prices recorded in the foregoing table are the weighted average of current quotations for all types of oil marketed from the field during the year specified. Hence the table gives little indication of the range in prices affecting the oil output of the different districts of that field over the same period. The prices quoted for the various grades of oil produced within the ten fields will be given in tables which follow.

The oil produced in the Appalachian field is commonly marketed under a classification involving eight grades, viz, Pennsylvania and Tiona, Mercer Black, Corning, New Castle, Wooster, Cabell, Somerset, and Ragland.

Pennsylvania and Tiona grade includes all the oil produced in New York and the bulk of that produced in the other States of the Appalachian field exclusive of Kentucky. Mercer Black applies to a heavy-gravity, dark-colored crude oil produced in Mercer County, Pa.; New Castle to a somewhat similar type of oil produced near New Castle, Monroe County, Ohio; Corning applies to a type of oil produced mainly in Perry County, Ohio; Wooster grade is produced in the Wooster field, Wayne County, Ohio; Cabell grade is produced in Lincoln and Cabell counties, W. Va. Most of the oil produced in Kentucky is classed as Somerset grade, only a small quantity from a single pool in Bath and Rowan counties being classed as Ragland grade.

The maximum and minimum prices quoted for the various grades of oil produced in the Appalachian field follow:

PENNSYLVANIA AND TIONA GRADE.

Year.	Highest price.	Lowest price.	Year.	Highest price.	Lowest price.
1900	$1.68	$1.05	1908	$1.78	$1.78
1901	1.45	.80	1909	1.78	1.43
1902	1.54	1.15	1910	1.43	1.30
1903	1.90	1.50	1911	1.35	1.30
1904	1.85	1.50	1912	2.00	1.35
1905	1.61	1.27	1913	2.50	2.00
1906	1.64	1.58	1914	2.50	1.45
1907	1.78	1.58	1915	2.25	1.35

MERCER BLACK GRADE (PENNSYLVANIA).

1909	$1.25	$0.90	1913	$2.00	$1.53
1910	.90	.87	1914	2.00	1.02
1911	.92	.87	1915	1.75	.97
1912	1.53	.92			

CORNING GRADE (OHIO).

1900	$1.51	$0.88	1908	$1.14	$1.14
1901	[1] 1.13	[1] .88	1909	1.14	.79
1902	[1] 1.29½	[1] .98	1910	.79	.77
1903	[1] 1.68¾	[1] 1.30	1911	.82	.77
1904	[1] 1.65	[1] 1.29	1912	1.53	.82
1905	1.17	.94	1913	2.00	1.53
1906	1.16	1.10	1914	2.00	.85
1907	1.14	1.10	1915	1.75	.83

NEW CASTLE GRADE (OHIO).

1900	$1.43	$0.80	1908	$1.22	$1.22
1901	[1] 1.05	[1] .80	1909	1.22	.87
1902	[1] 1.33¾	[1] .90	1910	.87	.84
1903	[1] 1.75⅜	[1] 1.37	1911	.89	.84
1904	[1] 1.72	[1] 1.37	1912	1.53	.89
1905	1.42	1.19	1913	2.00	1.53
1906	1.41	1.35	1914	2.00	1.02
1907	1.39	1.22	1915	1.75	.97

CABELL GRADE (WEST VIRGINIA).

1905	$1.25	$1.06	1911	$0.99	$0.94
1906	1.24	1.24	1912	1.60	.99
1907	1.32	1.18	1913	2.07	1.60
1908	1.32	1.32	1914	2.07	1.05
1909	1.32	.97	1915	1.78	.97
1910	.97	.94			

WOOSTER GRADE (OHIO).

1912	$1.53	$1.02	1914	$1.91	$1.15
1913	1.91	1.53	1915	1.50	1.05

[1] Average monthly price.

SOMERSET GRADE (KENTUCKY).

Year.	Highest price.	Lowest price.	Year.	Highest price.	Lowest price.
1900	$1.05	$0.69	1908	$1.00	$1.00
1901	.89	....	1909	1.00	.72
1902	....	....	1910	.72	.72
1903	....	....	1911	.79	.72
1904	1.30	.91	1912	1.15	.79
1905	.91	.75	1913	1.35	1.15
1906	.91	.85	1914	1.35	.85
1907	1.20	.85	1915	1.63	.80

RAGLAND GRADE (KENTUCKY).

1904	$0.66	$0.58	1910	$0.50	$0.45
1905	.58	.49	1911	.48	.45
1906	.62	.49	1912	.65	.48
1907	.75	.55	1913	.70	.65
1908	.75	.65	1914	.70	.65
1909	.65	.50	1915	.75	.63

The oil produced in the Lima-Indiana field is commonly marketed under a classification involving four grades, viz, North Lima, South Lima, Indiana, and Princeton. North and South Lima grades include the oils of slightly different characteristics produced in the northwestern part of Ohio. Indiana grade includes all petroleum produced in the State of that name with the exception of that produced in the Princeton pool, Gibson County, which is similar in character to Illinois oil and receives a separate classification.

The following tables show the maximum and minimum prices quoted for crude petroleum produced in the Lima-Indiana field each year since 1900:

Year.	North Lima grade.		South Lima grade.		Indiana grade.		Princeton grade (Indiana).	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1900	$1.26	$1.01	$1.21	$0.96	$1.21	$0.96	....	....
1901	.94	.79	.89	.74	.89	.74	....	....
1902	....	....	....	....	....	....	....	....
1903	1.38	1.11	1.33	1.06	1.33	1.06	....	....
1904	1.36	1.00	1.31	.95	1.31	.95	....	....
1905	1.01	.86	1.96	.81	.96	.81	....	....
1906	.98	.90	.93	.85	.93	.85	....	....
1907	.94	.90	.89	.87	.89	.87	....	....
1908	1.04	.94	.99	.89	.99	.89	$0.68	$0.68
1909	1.04	.84	.99	.79	.99	.79	.68	.60
1910	.84	.82	.79	.77	.79	.77	.60	.60
1911	.84	.82	.79	.77	.79	.77	.67	.60
1912	1.25	.84	1.20	.79	1.20	.79	1.05	.67
1913	1.49	1.25	1.44	1.20	1.44	1.20	1.45	1.05
1914	1.49	.93	1.44	.88	1.44	.88	1.45	.89
1915	1.33	.88	1.33	.83	1.18	.78	1.47	.84

Illinois grade includes all the petroleum produced in Illinois with the exception of that produced in McDonough County in the northwestern part of the State which is classed as Plymouth grade.

The following table shows the highest and lowest market quotations for crude oil produced in the Illinois field:

ILLINOIS GRADE.

Year.	Highest price.	Lowest price.	Year.	Highest price.	Lowest price.
1905	$0.70	$0.60	1911	[1] $0.67	[2] $0.52
1906	.83	.64	1912	[1] 1.08	[2] .57
1907	.68	.64	1913	1.45	1.05
1908	[1] .68	[2] .60	1914	1.45	.89
1909	[1] .68	[2] .52	1915	1.47	.84
1910	[1] .60	[2] .52			

PLYMOUTH GRADE.

Year.	Highest. price.	Lowest price.
1915	$1.33	$0.58

[1] Above 30° B.

[2] Below 30° B.

Mid-Continent oils, though varying considerably in character from pool to pool, are now classed as Kansas and Oklahoma grade with the exception of that produced in the Healdton district, Oklahoma, which, because of its sulphur and its low content of light gravity product, is classed separately as Healdton grade.

The following table shows the highest and lowest quotations for petroleum produced in the Mid-Continent field:

KANSAS AND OKLAHOMA GRADE.

Year.	Highest.	Lowest	Year.	Highest.	Lowest.
1903	[1] $1.38	[2] $0.60	1910	[6] .42	[7] .28
1904	[1] 1.36	[2] .46	1911	.50	.44
1905	[3] .80	[4] .25	1912	.83	.50
1906	[3] .52	[5] .26	1913	1.03	.83
1907	[3] .41	[5] .26	1914	1.05	.55
1908	[3] .41	[5] .28	1915	1.20	.40
1909	[6] .41	[7] .28			

HEALDTON GRADE (OKLAHOMA).

1914	$1.03	$0.50	1915	$0.60	$0.30

[1] Light.

[2] Heavy.

[3] 32° B. and above.

[4] 29½° to 30° B.

[5] Below 28° B.

[6] 30° B. and above.

[7] Below 30° B.

Petroleum produced in the fields of northern Texas is classed as Electra grade from the fields in Wichita County, Moran grade from Shackelford County, Henrietta grade from Clay County, Strawn grade from Palo Pinto County, Thrall grade from Williamson County, and Corsicana light or Corsicana heavy (Powell) from Navarro County.

The following table shows the highest and lowest quotations for petroleum in the various pools of the North Texas field:

PRICES OF NORTH TEXAS OILS

Year.	Electra.		Henrietta.		Corsicana light.		Corsicana heavy (Powell).		Thrall.		Strawn.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1900					$1.11	$0.81						
1901					.98	.66	$0.60	$0.20				
1902					[1] 1.72		[1] .21					
1903					1.32	1.06	.60	.35				
1904			[1] $0.475		1.27	.70	.55	.40				
1905			.50	$0.45	.91	.81	.50	.50				
1906			.65	.65	1.00	.89	.60	.52				
1907			.95	.93	1.02	1.00	.70	.65				
1908			.93	.45	1.00	.70	.70	.45				
1909			.53	.48	.70	.70	.53	.48				
1910			.55	.53	.70	.55	.55	.50				
1911	$0.55	$0.55	.55	.55	.58	.58	.50	.50				
1912	.88	.50	.88	.50	.83	.50	.70	.50				
1913	1.05	.88	1.05	.88	1.05	.83	.80	.70				
1914	1.05	.60	1.05	.60	1.05	.60	.80	.50				
1915	1.20	.45	1.20	.45	1.20	.45	.60	.40	$1.20	$0.65	$1.05	$0.65

[1] Yearly average price.

Petroleum produced in the fields of northwest Louisiana is classed as Caddo light or heavy, De Soto, and Crichton grades, depending on its source, whether from Caddo, De Soto, or Red River parishes.

The following table shows the highest and lowest average monthly quotations on petroleum of Caddo grade since 1907:

Year.	Highest.	Lowest.
1907	[1] $0.85	[2] $0.63
1908	[1] .73½	[2] .30
1909	[1] .60	[2] .40
1910	[1] .60	[2] .38
1911	[1] .62	[2] .40
1912	[1] $0.91	[2] $0.40
1913	[1] 1.05	[2] .60
1914	[1] 1.05	[2] .45
1915	[3] 1.20	[2] .35

Year.	De Soto grade.		Crichton grade.	
	Highest.	Lowest.	Highest.	Lowest.
1913				
1914	[4] $0.952			
1915	1.10	$0.50	$0.85	$0.40

[1] Caddo light. [2] Caddo heavy. [3] 38° B. or above. [4] Yearly average price.

Petroleum produced in the various pools of the Gulf Coastal plain varies somewhat in character with the pool, though all the oil produced in this major field is characterized by an asphalt base, by the presence of sulphur, and by a low yield of gasoline by ordinary fractionation methods of refining. Prices of oil produced in this major field vary from pool to pool, as shown in the following tables;

PRICES OF GULF-COAST OILS.

Year.	Spindletop (Texas).		Sour Lake (Texas).		Jennings (Louisiana).		Welch (Louisiana).		Batson (Texas).	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1900	....	....	....	....	....	....	....	....	....	....
1901	[1] $0.175	....	....	....	....	....	....	....	....	....
1902	[1] .2045	....	[1] $0.3215	....	[1] $0.344	....	....	....	....	....
1903	....	....	.60	$0.15	[1] .437	....	[1] $1.00	....	[1] $0.25	....
1904	[2] .48	$0.268	[2] .465	.28	[2] .57	$0.18	[1] .681	....	[2] .46	$0.20
1905	.52	.30	.36	.20	[2] .27	.12	[1] .75	....	[2] .41	.20
1906	.75	.51	.75	.40	[2] .65	.234	[1] .726	....	.75	.30
1907	.98	.70	[2] .97	.655	1.08	.62	[1] .742	....	.95	.72
1908	[2] .791	.4076	92	.43	[2] .792	.43	[1] .750	....	.84	.40
1909	.82	.58	.80	.54	.86	.60	[1] .760	....	.77	.53
1910	.83	.77	.84	.72	.87	.65	[1] .841	....	.80	.72
1911	.79	.70	.80	.65	.70	.55	[1] .852	....	.73	.65
1912	.80	.70	.75	.65	[2] .92	.625	[1] .843	....	.75	.65
1913	1.06	.84	[2] 1.08	.875	1.02	.78	[1] .859	....	1.00	.75
1914	1.04	.40	1.06	.40	1.00	.45	[1] .946	....	1.00	.40
1915	.60	.40	.65	.50	.45	.40	(3)	....	.50	.40

Year.	Saratoga (Texas).		Humble (Texas).		Dayton (Texas).		Vinton (Louisiana).		Edgerly (Louisiana).	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1900	....	....	....	....	....	....	....	....	....	....
1901	....	....	....	....	....	....	....	....	....	....
1902	....	....	....	....	....	....	....	....	....	....
1903	....	....	....	....	....	....	....	....	....	....
1904	[2] $0.38	$0.20	....	....	....	....	....	....	....	....
1905	[2] .35	.22	$0.20	$0.15	$0.34	$0.19	....	....	....	....
1906	.75	.29	.75	.34	[2] .434	....	....	....	....	....
1907	.94	.66	.99	.62	.86	.65	....	....	....	....
1908	[2] .887	.40	[2] .913	.43	.61	.41	....	....	....	....
1909	.80	.53	.80	.54	.72	.50	....	....	....	....
1910	.84	.70	.80	.72	.72	.70	[1] $0.50	....	....	....
1911	.75	.65	.78	.65	.70	.60	.53	$0.39	....	....
1912	.75	.65	.75	.65	.70	.67	.75	.50	....	....
1913	[2] 1.00	.875	[2] 1.00	.875	.80	.75	.90	.73	....	....
1914	1.00	.40	1.00	.40	.75	.40	1.00	.40	$0.90	$0.40
1915	.60	.40	.50	.30	.50	.30	.60	.30	(3)	....

[1] Yearly average price. [2] Monthly average price. [3] Data not available.

Monthly prices of crude petroleum in the Colorado and Wyoming fields are not available in the department, but in view of the fact that such variation is slight the average yearly prices shown with the statistics of marketed production in a foregoing table furnish a good index to the annual fluctuations.

Petroleum produced in California is all of asphalt base and is now classed on the basis of specific gravity expressed in degrees Baumé.

No consistent classification has been followed in past years, and a general summary of price variations is not practicable.

The following table shows the quotations for California petroleum posted by the Standard Oil Co. of California on December 28, 1915:

San Joaquin Valley fields:	
14° B. to and including 17.9° B	$0.43
18° B. to and including 18.9° B	.44
For each increase in gravity above 18° B., 1 cent per barrel is added.	
Ventura County pools:	
25° B. to and including 25.9° B	.67
For each increase of 1° B. above 25° B., 1 cent per barrel is added.	
Whittier Fullerton district:	
16° B. to and including 17.9° B	.48
18° B. to and including 18.9° B	.49
For each increase of 1° B. above 18° B., 1 cent per barrel is added.	

These quotations do not vary greatly from month to month or from year to year.

In addition to the prices quoted for oil in each of the major fields, bonuses ranging from 2 to 50 cents a barrel are paid by various purchasing agencies and refiners for types of crude oil suited to their particular needs.

The following table summarizes in round numbers the total marketed production of crude petroleum in the United States from 1900 to 1915, inclusive, and shows for comparison the crude oil production of the entire world during that period, in barrels of 42 gallons:

Year.	United States.	Entire world.	Year.	United States.	Entire world.
1900	63,600,000	149,100,000	1908	178,500,000	285,100,000
1901	69,400,000	167,400,000	1909	183,200,000	298,400,000
1902	88,800,000	182,000,000	1910	209,600,000	327,600,000
1903	100,500,000	194,800,000	1911	220,400,000	345,700,000
1904	117,100,000	218,300,000	1912	222,900,000	352,500,000
1905	134,700,000	215,400,000	1913	248,400,000	384,700,000
1906	126,500,000	214,000,000	1914	265,800,000	400,500,000
1907	166,100,000	264,900,000	1915	[1] 267,400,000	(2)

[1] Estimated.

[2] No figures available.

5. What fields, and to what extent, are becoming exhausted?

Considering only those portions of the 10 fields already described which have been demonstrated by drilling to contain oil, the best estimates from available information indicate for each of the fields the percentage of exhaustion shown in the following table:

Field.	Present gasoline factor (per cent).	Production including 1915 (millions of barrels).	Estimated percentage of exhaustion.
Appalachian	25	1,150	74
Lima-Indiana	12	438	93
Illinois	18	251	60
Mid-Continent	18	617	50
North Texas	20	44	41
Northwest Louisiana	20	58	47
Gulf Coast	3	236	79
Colorado	20	11	79
Wyoming	20	12	5
California	2½	835	34

6. *What new fields have been developed during said period, and the production of such new fields?*

With the exception of the Appalachian field, the Lima-Indiana field, and the Colorado field, all of the oil fields described in answer to question 3 have had their major development since the beginning of 1900.

In certain pools relatively minor developments had, up to 1899, inclusive, resulted in a total yield of 6,000 barrels in the Illinois field, of 450,000 barrels in the Mid-Continent (Kansas and Oklahoma) field, of 1,280,000 barrels in the North Texas field, of less than 2,500 barrels in the Gulf field, and of 23,000 barrels in the Wyoming field. Even the production of the California field from 1876 to 1899, though it aggregated 15,000,000 barrels to the end of the latter year, must be regarded as of minor importance compared with present total output.

The annual output of these fields since 1900 is shown in the tables submitted in answer to questions 3 and 4.

7. *What known fields or areas are yet undeveloped, and what are their possibilities for oil and gasoline production in the United States and elsewhere?*

Adjacent to or near many of the productive areas already discovered in the major oil fields of the United States there are additional areas which are to be regarded as prospective oil territory, because they include geological formations that elsewhere carry oil, and because they either possess known or inferred geologic structures favorable to oil accumulation or disclose surface indications of oil. Other regions more remote, but also presenting favorable geologic conditions so far as they can be observed at the surface, must likewise be counted, though in many cases with less confidence, among the probable or possible oil fields of the future.

Taking into account the productive possibilities, not only of pools already demonstrated to contain oil, as noted in answer to question 5, but also of these untested areas in which the geologic evidence is promising, the following conservative estimates of the percentage of exhaustion and of the quantity of petroleum that remains available for commercial extraction in the respective regions are submitted:

Field.	Estimated percentage of exhaustion of total oil content.	Petroleum remaining in fields (millions of barrels).
Appalachian	70	481
Lima-Indiana	93	31
Illinois	51	244
Mid-Continent	25	1,874
North Texas	8	484
Northwest Louisiana	22	124
Gulf	13	1,500
Colorado	65	6
Wyoming and Montana	2	540
California	26	2,345
Total		7,629

In addition to the major fields considered in the foregoing list, the Territory of Alaska and the States of Arizona, Utah, New Mexico, Michigan, Arkansas, Alabama, Nebraska, Missouri, Washington, and Mississippi contain areas of potential oil production which may add 75,000,000 barrels or more to the above total.

The possibilities of finding oil in Oregon, North Dakota, South Dakota, and in the coastal regions of the Middle and South Atlantic States, which have not been included in the above estimates, should not be overlooked.

The possibilities of gasoline production might be calculated by applying the present gasoline factor given for each field in the table in the answer to questions 3 and 4, but on the one hand this gasoline content has been known to decrease materially even during the life of a pool and on the other hand it is expected that the gasoline factor will be increased largely as stated in the answer to question 8.

No estimates are warranted for possibilities outside the United States.

8. *What new method or methods have been evolved to increase the percentage of gasoline produced from the crude oil, or to cheapen the cost of production in any way?*

(*a*) The extraction of gasoline from natural gas by compression is a new method. The production of gasoline from this source in five years is as follows:

	Barrels.
1911	177,000
1912	286,000
1913	573,000
1914	1,016,000
1915	1,500,000
Total	3,552,000

This gasoline may be blended with heavier distillates from petroleum.

(*b*) The usual refinery practice is to produce a number of gasolines of different gravities, such as 74°, 70°, 68°, and so on down to 60° gravity. If refinerers, instead of making gasoline of different gravities, would blend the higher grades with lower distillates, making a single grade of 60° gravity, this would increase the gasoline yield 3 to 4 per cent, or more than 1,000,000 barrels per annum.

(*c*) By improved design of carburetors and internal combustion engines, it is possible to use heavier oils than have heretofore been considered practicable. Six or seven years ago gasoline of at least 70° gravity was desired, while to-day a gravity of 60° is quite satisfactory. This in part explains why ten years ago only from 10 to 12 per cent of gasoline was extracted from Pennsylvania crudes, whereas to-day the same crude yields twice that amount; likewise Indiana and Oklahoma crudes are yielding double the porportion of gasoline to-day that they yielded ten years ago.

(*d*) The Burton cracking process for producing gasoline (motor spirits) from certain low grade petroleum distillates is a process patented and owned by the Standard Oil Co. The production from it is in excess of 3,000,000 barrels per annum. This gasoline output is equivalent to the ordinary gasoline recovery from 18,000,000 barrels of crude oil containing 17 per cent of gasoline, or more than 10 per cent of the total production of crude for the past year, exclusive of California. Kerosene, heavy residuum oils, and asphaltic crudes are not at present used in this process.

(*e*) The Rittman cracking process for producing gasoline (motor spirits) from petroleum distillates was brought out by the Bureau of Mines in 1915. Application for patent is pending in the Patent Office. At the present time seven refineries in six States are installing plants to use this process, which not only increases the yield of gasoline but utilizes for this purpose crude oil, kerosene, or any other low-grade distillate.

(*f*) There are other cracking processes for making gasoline from inferior oils, such as kerosene, fuel oil, residuum, etc., and numerous patents have been issued. These other processes are at the present time not as promising as are the Burton or Rittman processes, but their further development may materially increase the future production of gasoline.

9. To what new uses have gasoline and petroleum or coal oil been applied during the said period?

The new uses of gasoline and kerosene (coal oil) are of comparatively minor importance. The consumption of gasoline has been due to the tremendous growth of old uses.

The principal uses of gasoline to-day are as follows:

(*a*) Automobiles, motor boats, motor cycles, and air craft.
(*b*) Stationary internal-combustion engines.
(*c*) Tractors and other portable units.
(*d*) General industrial and household uses.

None of these uses have yet reached a stage where their future can be accurately forecasted.

The increase in the use of heavier fuel oils for steam purposes on railroads, in the naval and merchant marine service, and in industrial plants, has developed on a large scale during this period. Between 1906 and 1912 the consumption of fuel oil by railroads alone in the United States increased more than 100 per cent. Since the latter year this consumption has, however, remained practically stationary at about 31,000,000 barrels annually.

10. So far as the records of his department will disclose, what has been the production and consumption of gasoline in the world outside of the United States each year during said period?

No authentic figures are of record in this department regarding the world's production and consumption of gasoline.

The relative importance of the domestic production of gasoline may in a general way be inferred from the facts set forth in the table under 3 and 4, which gives the production of crude petroleum for both the United States and the entire world, and also in the table of gasoline exports under 2.

11. To what extent have the war conditions in Europe influenced the production and consumption of gasoline?

An indication of the effect of the war on our production of gasoline is shown by the increased exports of gasoline (naphtha and lighter products). The exports for 1914 exceeded those of 1913 by 500,000 barrels and the exports for 1915 exceeded those of 1914 by 1,500,000 barrels.

A comparison of exports by months is given in the table under 12 (*b*).

12. What cause, if any, can be given for the sudden, extraordinary rise in the retail price of gasoline?

(*a*) Increased consumption of gasoline within the United States. Various trade journals estimate that the consumption of gasoline in the United States during 1915 was 25 per cent greater than in 1914, and that there will be a like increase in 1916.

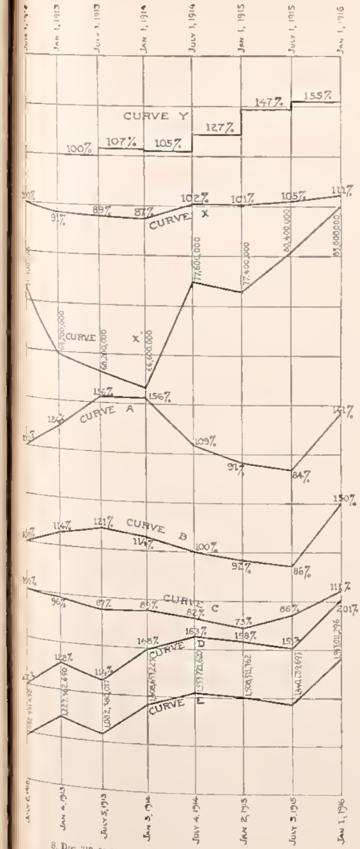
(*b*) Increase in exports. The following table shows the combined gasoline and naphtha exports by months for the years 1913–1915:

Month.	1913	1914	1915
	Barrels.	*Barrels.*	*Barrels.*
January	160,000	150,000	325,000
February	325,000	280,000	550,000
March	350,000	320,000	525,000
April	550,000	550,000	480,000
May	450,000	540,000	600,000
June	320,000	430,000	680,000
July	380,000	650,000	550,000
August	390,000	270,000	700,000
September	490,000	550,000	490,000
October	510,000	560,000	430,000
November	280,000	400,000	640,000
December	250,000	300,000	530,000
Total	4,455,000	5,000,000	6,500,000

(*c*) The depletion of gasoline stocks due to increased domestic and export demands. On January 1, 1915, refiners had stocks of gasoline in storage amounting to at least 2,000,000 barrels. Inquiry to-day indicates that there is little gasoline in storage.

(*d*) Decreased production of crude containing a large percentage of gasoline, as in the Cushing pool of Oklahoma, the daily production of which declined from more than 300,000 barrels in April, 1915, to less than 100,000 barrels in January, 1916. The decline of the Cushing pool was partially compensated for by an increased production of crude from other pools, the gasoline content of which production, however, was from 5 to 7 per cent less than that of the Cushing crude.

The stocks of Cushing crude, while from 10,000,000 to 15,000,000 barrels larger at the end of 1915 than at the beginning of that year, reached their maximum in July. This surplus is now being drawn on to supply the shortage represented by the difference between daily production and existing transportation and refining capacity, and thus until exhausted this surplus tends to steady the oil market. These stocks, however, are controlled by the stronger companies, and have been withdrawn from the open market. Thus, while there is a market shortage of Cushing crude, which is directly responsible for



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July, 1912, to January, 1916.

Curves, except curve "Y", based on figures at beginning of each half-year. No account taken of intervening fluctuations.

Curve Y:	Exports of Gasoline during each six-month period, based on percentages of the exports between January 1, and July 1, 1913.
Curve X:	Crude oil held in storage by pipe line companies in the Appalachian, Lima-Indiana, Illinois, and Mid-Continent fields, based on percentages of the amount in storage July 1, 1912.
Curve X':	Crude oil held in storage by pipe line companies in the Appalachian, Lima-Indiana, Illinois, and Mid-Continent fields, based on actual amount in barrels.
Curve A:	Market price of Pennsylvania crude at the well, based on percentages of the price of July 6, 1912.
Curve B:	Market price of Gasoline in steel barrels at New York, based on percentages of the price of July 6, 1912.
Curve C:	Course of the Stock Market as indicated by the high average price of 50 stocks, 25 railroads and 25 industrials. Based on percentages of the high average price of July 1, 1912. Computed from the "Annalist Curve" in "The Annalist" for January 3, 1916.
Curve D:	Market value of the stocks of 35 domestic companies (not including Penn-Mex) comprising the Standard Oil Group, based on percentages of the value on July 6, 1912. Market value taken as the sum of the results obtained by multiplying the number of shares of common stock of each company by the respective ask prices per share. No account taken of preferred stock. Capitalization from "Moody's Manual"; quotations from "The Commercial and Financial Chronicle".
Curve E:	Market value of the stocks of 35 domestic companies (not including Penn-Mex) comprising the Standard Oil Group, based on the number of shares of common stock of each company multiplied by the respective ask prices per share. No account taken of preferred stock. Capitalization from "Moody's Manual"; quotations from "The Commercial and Financial Chronicle".

some of the independent refiners paying a premium of from 20 to 50 cents a barrel above the quoted market price, other companies have not exhausted their 1915 surplus of Cushing crude. Since these larger companies have in fact larger stocks than a year ago, it follows that with them the shortage of gasoline-rich crude is at most only threatened and to the extent that these companies are using their 1915 surplus, the threatened shortage is not yet a factor in increasing the cost of gasoline production.

(*e*) Increase in the price of crude oil. For study and comparison the price of Pennsylvania grade crude at the well and the price of gasoline in steel barrels in New York are taken as typical and fair indexes of conditions throughout the country, perhaps excepting California. For the last three and one-half years (July 1, 1912, to Jan. 1, 1916), considered by six months periods, the price of crude and the price of gasoline have risen and fallen at the same time, but not always in the same amount. Until the first of last July the percentage of fluctuation of the price of crude was considerably greater than that of gasoline, but since that date the percentage rise in gasoline price has been slightly more rapid than that of crude. (See Pl. I, curves A and B.) This latter relation is more clearly shown by considering the prices month by month for the year 1915. During the month of January the price of gasoline dropped, while the price of crude was rising; during March and April gasoline remained stationary while crude was falling; during July gasoline remained stationary while crude was rising rapidly; and since August 1, gasoline has gone up relatively faster than crude, its rapid rise being uninterrupted by the stationary price of crude during November. These facts are shown graphically on Plates I and II, curves A and B, and are stated in the following table:

	Gasoline prices per gallon.	Crude oil prices per barrel.		Gasoline prices per gallon.	Crude oil prices per barrel.
1915.	*Cents.*		1915.	*Cents.*	
Jan. 1	13	$1.45	Sept. 1	14	$1.70
Feb. 1	12	1.50	Oct. 1	16	1.80
Mar. 1	12	1.50	Nov. 1	17	2.00
Apr. 1	12	1.40	Dec. 1	19	2.00
May 1	12	1.35			
June 1	12	1.35	1916.		
July 1	12	1.35	Jan. 1	21	2.25
Aug. 1	12	1.60			

(*f*) Financial influences. The recent rapid increases in the prices of crude oil and gasoline have been accompanied by rapid increases in the market quotations of oil company shares. The market values of the capital stocks of 38 corporations, of which 35 are in the Standard Oil group and 3 are typical large independent companies, have increased remarkably in the last six months. (See Pl. II, curves D and E.) The stocks of other oil companies probably show a similar rise, but the quotations are not at hand. The 38 companies selected are believed to represent all phases of the oil industry. These rapid increases might be ascribed to the general condition of prosperity and the general upward trend of the stock market but for the fact that during the last quarter of 1915 the oil company stocks did not rise and fall with the market. The weekly curve of "The

Annalist" showing the course of the stock market as indicated by the average price of 50 stocks—25 railroad and 25 industrial—shows that the market was rising rapidly during October, while the oil companies either remained stationary or fell off slightly. More striking, however, is the fact that during November, when the stock market was falling, the oil stocks were rising rapidly, and that during December the rise of oil stocks was many times more rapid than that of the general market. (See Pl. II, curves C, D, and E.) It should be noted also that the stocks of the three typical large independent companies have risen much more rapidly than those of the Standard group. (See Pl. II, curves D and E.) Other indications that the rise of oil stocks may be ascribed in part at least to increased profits are found in the following quotations, the first and second being from "The Commercial and Financial Chronicle" of New York for January 22, 1916:

> *Standard Oil of California—50 per cent stock dividend.*—A stock dividend of 50 per cent has been declared on the $49,686,655 stock, payable April 15 to holders of record March 4, along with the regular quarterly 2½ per cent cash distribution payable March 15 to holders of record February 9. (V. 100, p. 896.)
>
> *Imperial Oil Co.* (*Ltd.*), *Canada—Stock dividend.*—This company, which on November 15, 1915, filed with the secretary of state of Canada a certificate of increase of authorized capital stock from $15,000,000 ($11,000,000 outstanding) to $50,000,000 (par $100), has this week distributed a stock dividend of 100 per cent, thus increasing the outstanding stock to $22,000,000. The Standard Oil Co. of New Jersey is said to own an 80 per cent interest.
>
> The Financial Times of Montreal on November 27 said:
>
> The Imperial Oil Co. is one of the most progressive and promising of the subsidiaries of the Standard Oil Co. of New Jersey. In 1907 the company's outstanding capital stock amounted to only $1,000,000. Practically all additional sums up to $11,000,000 are said to have been for extensions, etc.)

The third quotation is from Petroleum Age of New York for December, 1915.

OIL AND GAS SECURITIES.

> Convincing proof of the amazing recovery within the oil industry in the last half of 1915 is furnished by the dividend declarations of the Standard Oil group for the last quarter, which reached the astonishing total of $21,788,636, which is the record for any quarter since the dissolution, with the exception of the first quarter of 1913, when Standard Oil Co. of New Jersey, made its famous 40 per cent cash distribution. True it is that of this sum, $4,890,000, representing the 15 per cent dividend of Illinois Pipe Line, 5 per cent by Prairie Pipe Line, and 3 per cent by Prairie Oil & Gas Co., will not be payable until January 15, but all of them are payable to December shareholders and represent distributions from 1915 profits.
>
> Including these sums, the total of regular and extra cash dividends since the dissolution in December, 1911, reaches the impressive total of $290,666,083, to which must be added stock dividends at par totaling $169,100,000. Taking into account the present market value of the distributed stock, the cash value of all distributions in the last four years by this group is in excess of half a billion dollars.
>
> The market effect of this enormous earning capacity is strikingly reflected in the steady appreciation in value of the old Standard Oil Co. of New Jersey stock "all on," which has risen from less than 650 at the time of the dissolution in December, 1911, to a new high record of 1770 during the current month. As the variation of price in this comprehensive security reflects the general trend of the oil securities markets, the accompanying "graph" will illustrate the course of the industry in the past four years.

That a cause for the increased price of gasoline and crude oil other than any present shortage of crude must be sought is shown by the reports of pipe-line company storage in the Appalachian, Lima-Indiana, Illinois, and Mid-Continent fields. During the months of August, September, and October, while the price of gasoline was rising rapidly the amount of oil in pipe-line storage was also increasing. (See Pl. II, curves X and B.) In other words, it would appear that during these months when the rapid decline of a remarkably productive pool foreshadowed a shortage of high-grade crude, the prospective shortage was promptly discounted by higher prices, although the amount of oil available to the larger transporting and refining companies was increasing. The cost of storage, including evaporation losses, must not be overlooked, but this cost by no means equaled the increase in market value of the crude during the period. The accumulated stocks were reduced somewhat during November and December, following the tendency indicated by the record of previous years. Thus the 18-month period, July, 1912, to January, 1914, was marked by an upward trend in the price of crude and by withdrawals from storage, which were more than replaced in the succeeding 18-month period of low prices. (See Pl. I, curves X and A.)

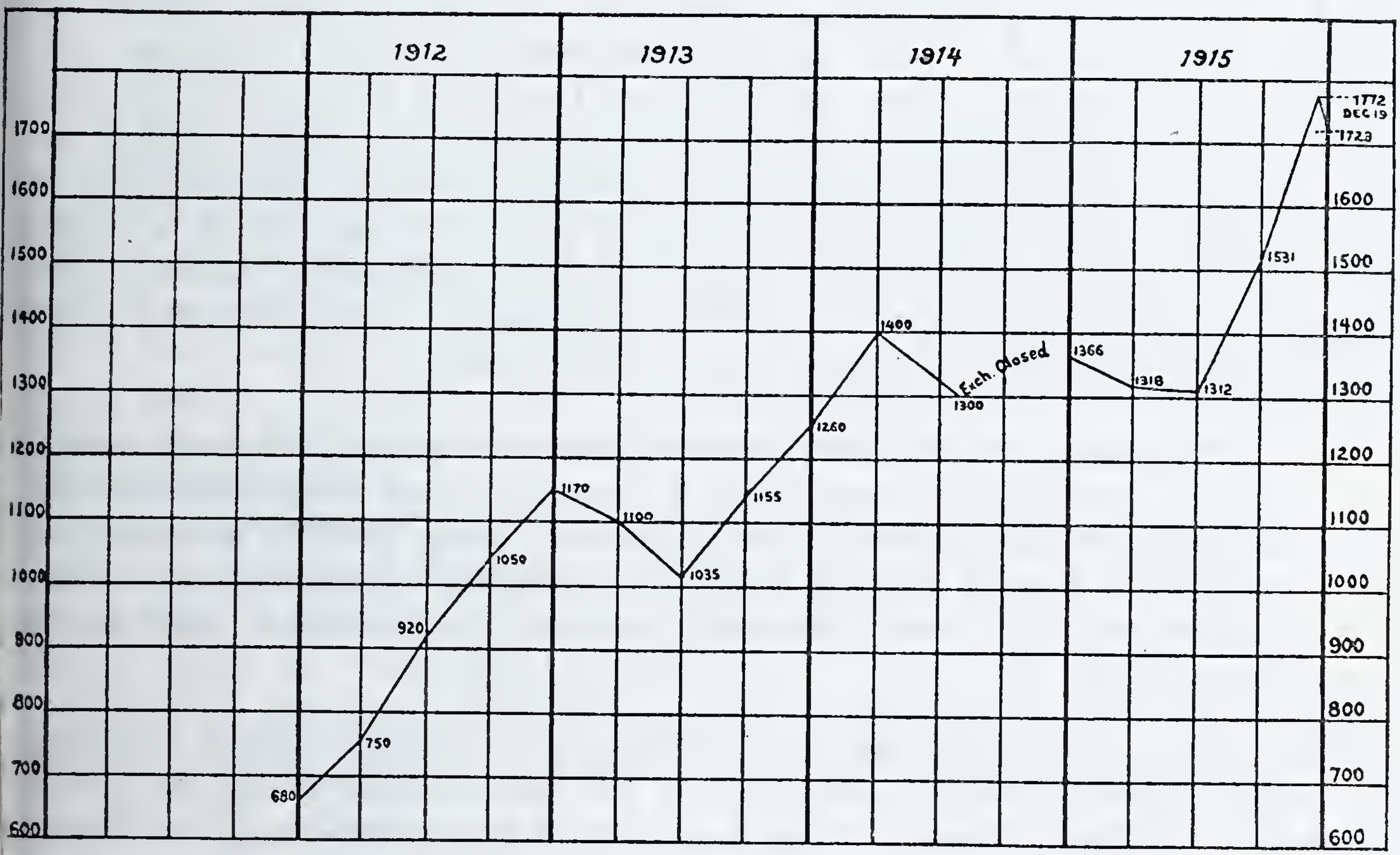

DIAGRAM SHOWING MARKET RANGE OF OLD STANDARD OIL CO. OF NEW JERSEY "ALL ON" SINCE THE DISSOLUTION

Notwithstanding the reduction of pipe-line stocks during November and December, at the end of the year the total stocks for the United States, both pipe-line and field storage, are estimated at more than 200,000,000 barrels. Thus, it is believed that the net increase in visible reserves of crude oil for the year was at least 45,000,000 barrels; that is to say, more than 15 per cent of the total production for 1915 went into storage. With the owners of these stocks, a shortage of crude must be considered only prospective.

RÉSUMÉ.

The extent to which the rapid and extraordinary rise in the price of gasoline can be traced to causes related to supply and demand has been indicated above. A conclusion justified by a review of the year's record in the oil industry is that the selling price of gasoline is fairly responsive to the supply and demand for gasoline, but is less directly related to the actual supply of crude oil. Attention has also been directed to the possibility of other contributing factors, with the result that the evidence at least suggests that increasing profits to the larger refining corporations have accompanied the upward trend of gasoline prices.

The obvious fact is that the refining and transporting companies that are strongest in business foresight and financial backing take advantage of both the falling and the rising markets in crude oil to strengthen an already strong position by purchasing both stocks of crude and producing properties. Under these conditions a market shortage of crude may develop which is not wholly warranted by facts of actual production, yet it no less surely leads to higher prices in both crude and refined products. This furnishes the opportunity for the well-supplied refiners to sell at the higher price gasoline which is derived from crude oil purchased in a lower market.

The net result of this clearly indicated business policy is that the consumer of gasoline pays a price, which in the case of the companies controlling the larger stocks of crude oil is not necessarily determined by the price paid to the producer for the oil from which the gasoline is obtained. The smaller refiners on the contrary, less favored with transportation and storage facilities and ready capital, may be so dependent for crude upon the current market that their cost of gasoline production is directly related to the current price of crude if indeed they do not have to pay a premium whenever a shortage is threatened. This advantage of larger profits to the stronger companies is perhaps inherent in the competitive system and must be recognized in any analysis of costs and prices.

13. *To what extent has the interior combustion engines been responsible for the increased consumption of gasoline, and what has been the extent of the increase of such engine and their general uses during said period, with special reference to number and increase of stationary engines, farm traction engines, automobiles, and motor boats, etc.?*

Authorities agree that the automobile and other internal combustion engines are primarily responsible for the increased consumption of gasoline. The statement has been made by several well-informed engineers that the horsepower of gasoline internal combustion engines in the United States is more than twice that of all engines in the United States driven by steam. The following figures indicate this increase in number of automobiles used:

	Number in operation Jan. 1.[1]
1899	[2] 10,000
1905	85,000
1910	400,000
1911	600,000
1912	677,000
1913	1,010,483
1914	1,253,875
1915	1,754,570
1916	2,225,000
1917	[2] 3,000,000

NOTE.—Various authorities estimate that the average consumption per automobile equals from 10 to 14 barrels per annum. This figure has been checked against inspection figures of States inspecting all gasoline sold.

On July 1, 1915, there were approximately 300,000 motor boats in the United States.
On Jan. 1, 1915, there were approximately 45,000 motor trucks in the United States.
On Jan. 1, 1916, there were approximately 30,000 farm tractor engines in the United States.

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[1] Figures of National Automobile Chamber of Commerce, based on State registration.
[2] Estimated.

14. What fields are now unproductive or limited in their production because of deficiencies in the laws in relation to the disposition of public lands containing deposits of oil, and what areas have been withdrawn from entry to await action by Congress?

The following areas are included in oil withdrawals (Jan. 15, 1916) pending the enactment of legislation replacing the wholly inadequate "oil-placer" law:

	Acres.
Alaska	Unknown.
Arizona	230, 400
California	1, 507, 547
Colorado	87, 474
Louisiana	414, 720
Montana	641, 622
North Dakota	84, 894
Utah	1, 952, 326
Wyoming	668, 094
Total	5, 587, 077

Of these areas only a part, varying in different States, is Government land, the remainder being either in private ownership or covered by valid existing entries or claims. The oil deposits in perhaps one-half of the withdrawn area, exclusive of Alaska, will prove to be in public ownership. No estimate can be made for Alaska, but any fields discovered will probably be in large part, if not wholly, Government land. Thus, the production in the fields west of Texas, Oklahoma, and Kansas is limited because of serious deficiencies in the public-land laws.

Active prospecting for oil in the public-land States is unquestionably retarded by reason of inadequate provision in existing laws and 650 million barrels is a conservative estimate of the quantity of oil under lands now in public ownership. Under the provisions of the withdrawal act and of later statutes reserving the oil from surface patents, oil production to this extent awaits action by Congress.

15. Any other information which may be useful or beneficial in the consideration of the subject of production and consumption of gasoline.

The situation may be summed up as follows:

The consumption of gasoline is rapidly increasing.

The production of crude has been generally regarded as near its maximum.

Some immediate relief may be afforded by means of the following:

(*a*) The use in internal combustion engines of heavier distillates approaching kerosene.

(*b*) An acceptable kerosene carburetor would at once go a long way toward relieving the present shortage of gasoline.

(*c*) General use of cracking processes whereby gasoline is made from kerosene and other less valuable petroleum oils. Such cracking processes are being rapidly developed and promise near relief. It is practicable to produce gasoline from kerosene, gas oil, fuel oil, residuums, and heavy crudes by present-day cracking processes, and no oil should be used for fuel that has not been so treated.

(*d*) Increasing the production of crude to furnish the necessary supplies of gasoline, but this is not to be recommended if it increases the output of distillates for which there is no market.

Looking to the future, benzol may be considered as a substitute for gasoline, and oil-shale as a substitute source of gasoline.

Benzol, a hydrocarbon not greatly different from gasoline, is recovered as a by-product in the manufacture of coke. At present benzol is not likely to find favor with automobile owners in the United States as a substitute for gasoline, although in general use in Europe. The objections made to it as a motor fuel are that it requires adjustments in the motor, and that the quantity of it available will be so limited as to preclude widespread distribution and ready availability at every cross-roads corner, which the gasoline user has come to expect.

The quantity of benzol produced in by-product coke ovens in the United States in 1915 was approximately 14,000,000 gallons, and at the present rate of production, and taking into account new plants under construction, the output in 1916 will be at least 22,000,000 gallons, or about 500,000 barrels. This quantity will be consumed in the manufacture of explosives, dyes, and chemicals such as carbolic acid, a type of demand, however, that is expected to be much smaller following the termination of the European war, which has resulted in the present high prices. Under normal conditions the price has been 20 cents or less a gallon.

The quantity of coal now made into coke is 60,000,000 to 70,000,000 tons annually and as under present practice the yield of benzol is 2 gallons from the ton of coal, the universal use of by-product ovens would increase the present production of benzol to over 3,000,000 barrels. The coal reserves available for the future production of benzol are enormous, but production of benzol as a substitute for gasoline can not be expected to draw on these reserves faster than the demand for coke and for by-products other than benzol justifies the coking or distillation of coal.

The oil shales in Colorado and Utah constitute an undeveloped reserve of petroleum, to which attention was directed by the Geological Survey in 1901. Field investigations of these deposits are being carried on by the survey to ascertain the distribution, richness, and quantity of these shales, and tests made by the Bureau of Mines to determine the most efficient methods of their utilization.

These oil-producing shales in northwestern Colorado have been examined with sufficient detail to warrant the estimate that there are 39 townships (1,400 square miles) underlain by an average thickness of 53 feet of shale in beds 3 feet or more in thickness, which, according to field tests, will on distillation yield an average of 25 gallons of crude oil per ton of shale. The crude oil thus obtained will give under ordinary refining practice approximately 9½ per cent gasoline, and doubtless much larger amounts by modern cracking processes. There is in northeastern Utah an oil-shale area approximately equal to that in Colorado, and it is estimated that the shale in this State will have equal thickness and quality, thus doubling the total possible yield. Oil shale beds generally thinner or less rich are present also in southwestern Wyoming, and similar shales are known in the Eastern States.

The net result of the examinations already made is that these oil-shale areas in Colorado and Utah constitute a latent petroleum reserve, whose possible yield is several times the total remaining supply of petroleum as estimated under the answer to question 7. The gasoline content of the petroleum that can be distilled from these shales can be conservatively stated in billions of barrels.

The development of this enormous reserve simply awaits the time when the price of gasoline or the demand for other distillation products warrants the utilization of this substitute source. This may happen in the near future. At all events these shales are likely to be drawn upon long before the exhaustion of the petroleum fields. Shales of no greater oil content have long been mined and distilled in Scotland.

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